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Megatrends in the transport sector and their impact on the Arab region

(Concept note)

Summary

The present document was drafted by the Economic and Social Commission of Western Asia (ESCWA) within the framework of preparatory studies to develop a common strategic vision on the development of multimodal transport to promote economic and social integration in the Arab region, so as to strengthen stability and growth and achieve inclusive and sustainable development.

The document reviews megatrends in the transport sector, which are influenced by various geographic, economic, social, regulatory, technological and political factors that together will contribute to moulding the global transport landscape over the period 2030-2050. These factors include the Chinese Belt and Road Initiative, the impact of climate change on opening new shipping lines through the Arctic Ocean, hyperloop trains with speeds exceeding 1,000 kilometres per hour, the use of clean energy sources and solar energy as alternatives to fossil fuels, the digital revolution and the regulatory solutions it provides, and self-driving vehicles, among other issues related to future developments in the transport sector and the potential new challenges for transport in the Arab region.

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Introduction

1. The transport sector is characterized by long periods of slow growth, punctuated with rapid and profound transformations in the form of singularities or revolutions in the development process, as a result of a combination of various factors known in some literature as the 'forces of change in the transport sector'[1] or as 'drivers of change in the transport sector' in more comprehensive and widespread references.[2]

2. Given the significant importance of infrastructure investments in the transport sector and their high cost, and the sector's strong impact on people's lifestyles and social and economic activities, it is vital that decision makers and those responsible for planning and managing the sector anticipate expected future trends to incorporate them into planning scenarios for the sector's future development to effectively meet changing needs in a timely manner.

3. The Economic and Social Commission for Western Asia (ESCWA) is preparing a project on formulating a strategic vision to develop a multimodal transport system in the Arab region, in collaboration with member States and in coordination with international and regional development bodies. The project focuses on revealing global transport megatrends and their potential implications for the Arab region, so as to prepare processes and strengthen cooperation to handle those trends and tackle their challenges.

4. The present document sets out the general framework for studying the major drivers of change in the transport sector and highlights the expected transformations in that field, for inclusion in the strategic vision. The present document serves as a basis for discussing ideas on the topic, which will be complemented by three expert group meetings on drivers of change and their expected implications for air, sea and land (road and rail) transport.

I. CONCEPTUAL FRAMEWORK

5. Transport, with its various aspects and economic, social and environmental dimensions, is considered a multidisciplinary scientific sector with various perspectives on how to study and solve challenges. The general systems approach is the most appropriate and integrated conceptual framework to explain the reciprocal influences between transport-related activities.

6. The General System Theory was developed by the Austrian biologist Ludwig von Bertalanffy over the period 1928-1968 as a general approach to understanding complex phenomena. It assumes the presence of a system consisting of various interrelated components of matter, energy and information, thus depicting the system as a specific entity with defined functions within its environment.[3]

7. The application of the systems approach to understanding the transport sector has gradually matured as a result of various consecutive intellectual contributions. Multilevel schematic representation, developed by Reichman, is considered the clearest conceptual framework for representing the transport system and its internal and external interrelationships (figure 1).

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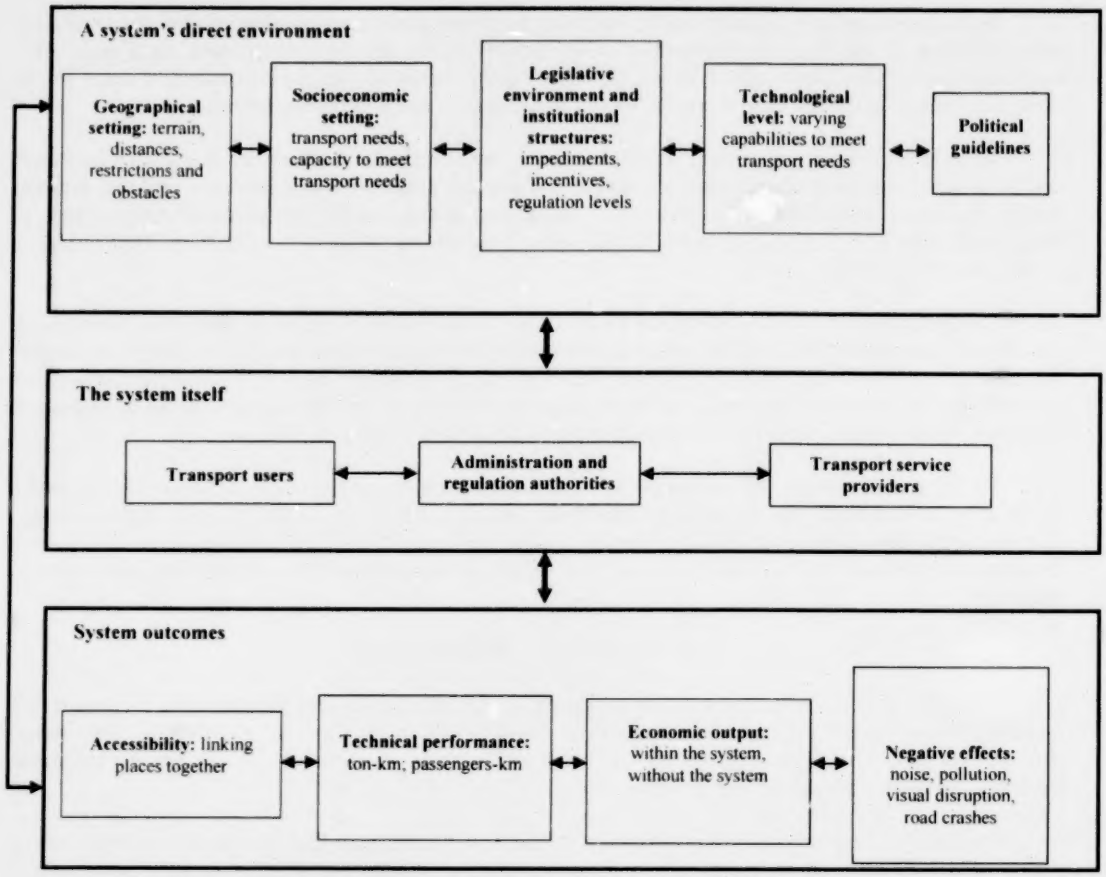
[1] ICF International, "Long range strategic issues facing the transportation industry: final research plan framework", paper prepared for National Cooperative Highway Research Program Project 20-80, Task 2, Fairfax, 2008.

[2] Jean-Paul Rodrigue, Claude Comtois and Brian Slack, *The Geography of Transport Systems*, 4th ed. (New York, Routledge, 2017).

[3] Ludwig von Bertalanffy, *General System Theory*, 3rd ed. (New York, Willy, 1968).

Figure 1. Schematic representation of the transport system


A system's direct environment
Geographical setting: terrain, distances, restrictions and obstacles
Socioeconomic setting: transport needs, capacity to meet transport needs
Legislative environment and institutional structures: impediments, incentives, regulation levels
Technological level: varying capabilities to meet transport needs
Political guidelines
The system itself
Transport users
Administration and regulation authorities
Transport service providers
System outcomes
Accessibility: linking places together
Technical performance: ton-km; passengers-km
Economic output: within the system, without the system
Negative effects: noise, pollution, visual disruption, road crashes

Source: S. Reichman, *Les transports : servitude ou liberté ?* (Paris, Presses universitaires de France, 1983).

8. The ESCWA secretariat set out a detailed explanation on the application of the systems approach to transport issues in a document on the relationship between transport and the Sustainable Development Goals (SDGs), which it presented to the Committee on Transport and Logistics at its seventeenth session, held in Cairo on 23 and 24 January 2017.[4] The present document will therefore only review the advantages of the systems approach in understanding transport system evolution mechanisms, and will identify the main drivers that could shape future evolution.

9. The main elements of Reichman's approach can be summarized as follows:

(a) To understand transport issues, it is necessary to analyse the reciprocal relationships and influences between the system's various components, its environment and its outcomes;

[4] E/ESCWA/EDID/2016/IG.1/5(Part I).

(b) Evolution in the transport sector is not always linear: the sector might temporarily stabilize in a given state because of the balance between different forces expressing conflicting interests. When this balance is upset, the system might move from a stable state to an unstable state or vice versa;

(c) Evolution in the transport sector occurs over the long term through significant structural transformations that generally accompany major changes in the system's environment, especially but not exclusively changes related to technological revolutions and their profound impact on the economy, society and people's way of living.

10. Below are the drivers of change affecting the transport sector as delineated in figure 1, which shows that the transport system's status, at any given time, is governed by the following factors:

(a) The system's geographical and environmental settings;
(b) The socioeconomic setting and the transport needs and solutions that it presents;
(c) The legislative environment, institutional structures and existing governance system;
(d) The technological level and the solutions and innovation it provides;
(e) Political guidelines and the resulting measures and decisions that impact the transport system.

11. Analysis of those factors reveals that evolution in the transport system occurs as a result of the reciprocal relationships between factors and between the components of the system itself: transport service providers transport people and goods in return for a fee, under the supervision of regulatory bodies responsible for setting comfort, safety and environmental standards and for ensuring their implementation. The system's future is affected by its current performance in terms of general satisfaction with connections between destinations, and with the quality of services that complement transport services and their impact on the economy, society and the environment.

II. TRANSPORT SECTOR TRENDS AND THEIR EXPECTED IMPACT ON THE ARAB REGION

12. In view of the above, by separating between population and social aspects, on the one hand, and economic and financing aspects, on the other, it becomes possible to study drivers of change in the transport sector according to the following groups of factors and the reciprocal relationships between them: geographic and environmental; macroeconomy and financing; population and social factors; government regulation; political factors and conflict; and technology.

A. GEOGRAPHIC AND ENVIRONMENTAL FACTORS

13. Geography impacts the transport sector through the nature of the terrain, which determines the type of transport used. Transport services differ between flat areas and rugged mountainous areas. For centuries, bodies of water formed natural borders dividing human settlements until water navigation was developed thus enabling sailing and exchanges across waterways, which were more rapid and efficient than land transport.

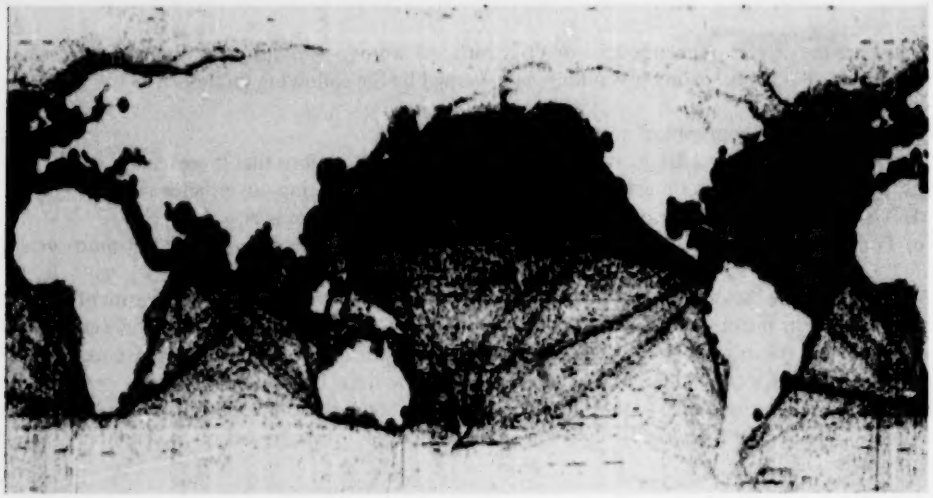
14. Throughout history, the Arab region's geographic location has been of great importance as an unavoidable transit corridor for the exchange of goods between various civilizations. Control of transit and trade corridors was a significant source of economic income, which contributed to the growth and prosperity of many cities and kingdoms in the Middle East, such as Yemen, Mecca, Petra and Palmyra, and resulted in the establishment of major cities that owed their existence to traditional trade in silk and spices, including Mosul, Damascus, Aleppo and Antakya, which were key hubs on traditional trade routes.

15. Today, the importance of marine transport for international trade is evident,[5] representing 70 per cent of the value of internationally traded goods and 80 per cent of the volume of those goods. Most goods are

[5] E/ESCWA/EDID/2016/IG.1/4(Part II).

transported by sea via a major shipping route that stretches between China in the East and North Europe and America in the West. This route services several major Arab ports in the Arabian Gulf (Dubai and Sharjah), the Arabian Sea (Salalah and Aden), the Red Sea (Jeddah and Aqaba), the Mediterranean Sea (Alexandria, Port Said, Damietta, Beirut and Lattakia), through to Tangiers on the Atlantic gateway to the Mediterranean Sea (figure 2).

Figure 2. Main east-west shipping route and the largest container ports



Source: United Nations Conference on Trade and Development (UNCTAD), *Review of Maritime Transport 2014* (New York and Geneva, 2014), p. 107.

16. In addition to international shipping, the Arab region's geographic location is also vital to air transport given its centrality between North-west Europe and South-east Asia. Many Arab airlines, especially Gulf airlines, have witnessed significant growth in passenger transit between North-west Europe and South-east Asia via major airports built for that purpose in the Arabian Gulf, including in Dubai, Abu Dhabi and Doha.

17. Nevertheless, this traditional advantage of the Arab region's geographic location is facing threats from various factors and projects, which could considerably reduce transit services through the Arab region, notably the Chinese Belt and Road Initiative; the possibility of opening a shipping route between Asia and Northern Europe through the Arctic Ocean; and the potentially weakened role of oil and gas as principal sources of energy worldwide because of environmental concerns.

1. *Belt and Road Initiative*

18. In September 2013, the Chinese President announced a strategic Chinese initiative to develop a network of land and sea routes to diversify Chinese export channels across the world. At the start, it was known as the One Belt One Road Initiative, then as the Belt and Road Initiative, and sometimes as the New Silk Road.[6] The initiative aims to finance various infrastructure projects in the field of transport and logistics to strengthen Chinese trade relations with emerging countries in Africa and Central Asia, on the one hand, and to develop

[6] The Economist, "What is China's belt and road initiative?", 15 May 2017, available at www.economist.com/the-economist-explains/2017/05/14/what-is-chinas-belt-and-road-initiative; and Tom Phillips, "The $900bn question: what is the belt and road initiative?", *The Guardian*, 12 May 2017, available at www.theguardian.com/world/2017/may/12/the-900bn-question-what-is-the-belt-and-road-initiative.

northern and western Chinese provinces that are relatively distant from major Chinese ports by directly linking them via rail to European markets, on the other.

19. The total value of the proposed projects under the initiative is estimated at around $1 trillion in roads, railways and sea port investments (figure 3).[7]

20. Advances in the development and implementation of the initiative's projects have raised questions about their potential impact on sea transport via the Suez Canal and the Mediterranean Sea to Northern Europe. They could also shift focus from major regional sea ports in the Arabian Gulf to new ports in the Indian Ocean, the Arabian Sea and the eastern coasts of Africa.

2. *Opening Arctic shipping lanes*

21. In the longer term, the current international shipping route through the Arab region could face competition. Climate change has revealed new shipping lanes, with potentially significant repercussions for sea transport in Arab countries. The steady rise in global temperature is melting the Arctic polar ice caps, opening the way for commercial sailing in ever-growing parts of the Arctic Ocean, and over longer periods of the year.

Figure 3. Main routes of the Belt and Road Initiative

Source: Geopolitical Intelligence Services, "What China's new silk road means for Europe", 27 November 2017. Available at www.gisreportsonline.com/debate-what-chinas-new-silk-road-means-for-europe,expert-view,2425.html.

22. A report by the United Nations Secretary-General, presented at the nineteenth session of the Commission on Sustainable Development of the Economic and Social Council, indicated the expected impact of receding ice in the Arctic Ocean, which could lead to the opening of new shipping lanes that reduce the distance between ports in South-east Asia, Northern and Central Europe and the eastern coast of North America by approximately 4,000 nautical miles.[8] Other studies have shown that new shipping routes, if permanently opened for trade activities, will reduce the distance between East Asia and Western Europe from 21,000

[7] BMI Research, *Trillion Dollar Trade Route: Winners along the Belt and Road* (London, 2017).

[8] E/CN.17/2011/4.

kilometres using the Suez Canal to 12,800 kilometres, and will decrease travel time by 10-15 days,[9] thus reducing costs. The stability of those shorter shipping lanes could result in the transfer of sea transport between North-east Asia and Northern and Central Europe to them, at the expense of the current sea route from the north-east of China to the Singapore Strait, and onwards to the Indian Ocean, the Arabian Sea, the Red Sea, the Suez Canal, the Mediterranean Sea, the Strait of Gibraltar and the North Sea. This transformation could lead to significant reductions in trade volume along the current route, thus negatively impacting sea transport in major ports such as Dubai, Salalah, Jeddah, Port Said, Beirut, Malta, Marseille and Tangiers.

23. The development of a commercial shipping route via the Arctic Ocean has attracted serious attention from the Russian Government, which decided in 2015 to increase the capacity of this route from 4 million tons to 80 million tons over 15 years. It is also working on developing maritime traffic regulations and on providing the required navigational support for the route, while focusing on preventing sea pollution.[10]

Figure 4. Comparison between the Arctic shipping route and the current Mediterranean route

Source: RT News, "Russian PM orders plan to increase Northern Sea Route capacity by 20 times", 9 June 2015. Available at www.rt.com/business/265756-northern-sea-route-medvedev.

24. In August 2017, for the first time in history, the Russian gas tanker Christophe de Margerie, owned by Sovcomflot, travelled between Norway and the Republic of Korea in a record-breaking 6.5 days at an average speed of 14 knots, without the assistance of an icebreaker. The Christophe de Margerie is the biggest ship built to Arc7 standards, enabling it to sail alone through 2.1 metre-thick ice. It is also the first among 15 ships to be able to transport gas from the Russian Port of Sabetta eastwards over six months of the year (between July and December), and westwards all year round. In the past, the high costs of insurance and icebreakers inhibited the use of the Northern Sea Route; however, the Christophe de Margerie has increased incentives to use that route, which is 30 per cent faster than passing through the Suez Canal.[11]

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[9] Jean-Paul Rodrigue, Claude Comtois and Brian Slack, *The Geography of Transport Systems*, 4th ed. (New York, Routledge, 2017).

[10] RT News, "Russian PM orders plan to increase Northern Sea Route capacity by 20 times", 9 June 2015. Available at www.rt.com/business/265756-northern-sea-route-medvedev/.

[11] Matt McGrath, "First tanker crosses northern sea route without ice breaker", *BBC News*, 24 August 2017. Available at www.bbc.com/news/science-environment-41037071.

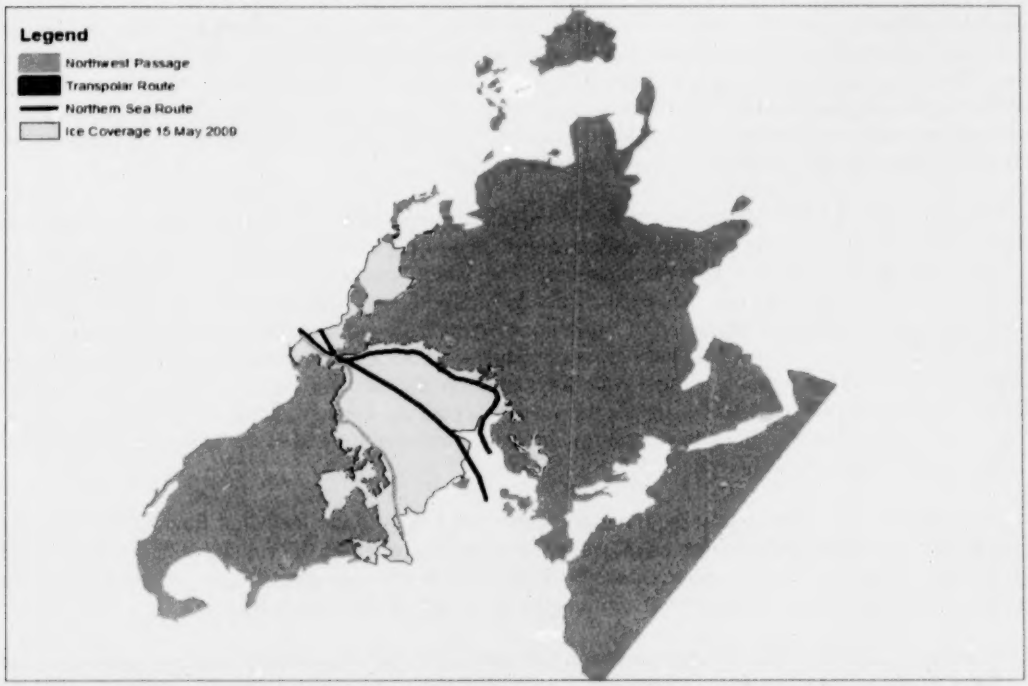
25. If this transformation becomes permanent, it will pose significant challenges for the Arab sea transport sector, which will lose the benefits it currently enjoys from sea transport via the main east-west route through the Suez Canal. It will be necessary to intensify efforts in trade integration between Arab countries, and between the Arab region and Europe and Asia, so as to ensure sufficient activity in major ports to compensate for the potential losses caused by transferring the main shipping route to the Arctic Ocean.

26. In a recent working paper, the *Centre d'études prospectives et d'informations internationales* (CEPII) projected that the steady rise in global temperature will allow for year-round shipping via the Arctic by 2050.[12] The paper also evaluates the effects of opening new shipping lanes in the Arctic on reducing distances between sea ports: it estimates an average reduction of 12.5 per cent, 15.1 per cent and 16.5 per cent, respectively, for three potential new lanes (the North-west Passage, the Transpolar Sea Route and the Northern Sea Route) as shown in figure 5, with the largest reductions affecting distances between Japan and Iceland (45.8 per cent), Japan and Norway (43.2 per cent), and the Republic of Korea and Iceland (41.8 per cent).

27. The paper shows that the overall impact of opening those new lanes will increase international trade by 0.32 per cent, resulting in a 0.02 per cent rise in global prosperity.

28. The paper also predicts that opening the Northern Sea Route will have a negative economic impact on countries in the Caribbean Sea, West Africa, the Mediterranean Sea and the Indian Ocean. Malaysia will be the most affected, with a 0.06 per cent drop in prosperity.

Figure 5. Projected Arctic shipping routes



Source: Jules Hugot and Camilo Umana-Dajud, "Breaking away from icebreakers: the effect of melting distances on trade and welfare", CEPII Working Paper, No. 2017-24 (Paris, Centre d'études prospectives et d'informations internationales, 2017).

[12] Jules Hugot and Camilo Umana-Dajud, "Breaking away from icebreakers: the effect of melting distances on trade and welfare", CEPII Working Paper, No. 2017-24 (Paris, Centre d'études prospectives et d'informations internationales, 2017).

3. *Reduced use of fossil fuels globally as an energy source*

29. Increasing environmental concerns could play a role in redesigning the transport sector, through international consensus on reducing polluting and greenhouse, gases. Given that petroleum products used in the transport sector cause emissions, trends are moving towards replacing oil with less polluting energy sources such as gas, and renewable energy such as wind and solar power. A 1990 prospective study conducted by a French research team led by Thierry Gaudin projects an increase in global energy consumption from 9,700 million tons of oil equivalent (TOE) in 2020 to 11,500 million TOE in 2060. However, it also predicts a drop in fossil fuel use (coal, oil and gas) as a share of total consumption over the same period, from 6,700 TOE to 3,500 TOE, thus increasing the share of other energy sources such as nuclear power and bionergy, especially solar energy, whose consumption will rise from 300 million TOE in 2020 to 1,500 million TOE in 2060.[13]

30. Decreasing global demand for fossil fuels will lead to a drop in oil transport from the Arab region to the rest of the world and to a decrease in revenue from oil extraction and export, which might cause a significant deficit in resources needed to achieve economic and social development in countries that rely on oil exports, including the reduced possibility of developing costly infrastructure for transport networks and of preserving the required maintenance to ensure the adequate level of services and safety standards.

B. MACROECONOMIC AND FINANCING FACTORS

31. The reciprocal relationship between transport and economic production is evidenced through the schematic representation of transport systems (figure 1). The transport sector itself can be a productive sector through the added value created by its various activities, including spatial value added achieved by transporting goods from production sites to consumption spaces at competitive prices, or time value added achieved through the provision of certain goods in the marketplace at a specific time (such as providing gifts before the Christmas period rather than after it, when demand drops and the products lose most of their value). Moreover, transport is critical to achieving value added in other economic sectors, since agricultural goods, semi-finished products, equipment and machinery need to be transported from production sites to consumption spaces to complete the cycle that enables the achievement of added value in any sector.

32. History is littered with lessons on the reciprocal relationships between economic factors and transport systems. Developments in transport have always contributed to the expansion of economic production, by allowing goods to travel farther while preserving their sale viability and competitiveness in new markets, thus increasing demand for production. Such expansion is generally the result of rapid developments in existing transport patterns, such as the expansion of water transport in Europe in the late seventeenth century when numerous water links were established between major navigable rivers, which interconnected human habitats, agricultural areas and sea ports.[14] Without waterways used for the efficient and low cost transport of coal, metals and agricultural products needed to feed the increasing numbers of people attracted by industry in cities, the Industrial Revolution would not have occurred in Europe between the end of the eighteenth century and the middle of the nineteenth century.

33. The second significant leap in the transport sector was linked to the Industrial Revolution itself: the steam engine was used to operate trains on railways, which greatly increased the volume of land transport and facilitated the transport of natural resources, crops and products to any area accessible by rail, thus increasing the gains of the Industrial Revolution by distributing its products wider and at a lower cost.

34. Container shipping is the contemporary mode of transport in the international economy, adopted in the last quarter of the twentieth century. Containers have significantly expedited the loading and unloading of ships, thus considerably reducing the cost of sea transport over ever-increasing distances, which played a large

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[13] Thierry Gaudin, éd., *2100, récit du prochain siècle* (Paris, Éditions Payot & Rivages, 1999).

[14] Bernard J. Smales, *Economic History: Made Simple* (London, W. H. Allen, 1975).

role in the transfer of key industries from their homelands in North America and Northern Europe to Southeast Asia so as to benefit from lower production costs and lower transport costs to reach consumers in rich countries.

35. The existing distribution system between production sites in South East Asia and consumption spaces in Northern Europe and North America could face threats in the future because of various factors discussed below.

1. *Relocation of industries to high-income countries*

36. There are increasing calls to relocate the industrial complexes of multinational organizations to high-income countries in Northern Europe and North America, so as to recreate job opportunities that those countries lost when the industrial complexes were moved to South East Asia in the early 1990s to benefit from lower production costs because of lower labour, land and building costs, among others.[15]

37. Several campains have been launched against the delocation of industrial complexes to South East Asia since the start of the phenomenon, with critics arguing that the move has increased unemployment in developed countries since the end of the 1990s.[16]

38. In the second decade of the twenty-first century, demands to move industries back to developed countries have taken a new turn, becoming more intense since President Trump (who was sworn in on 20 January 2017) decided to incorporate the issue into his work programme. He campaigned on promises to reinvigorate goods produced in the United States. Since his election, Trump has threatened to punish American enterprises that insist on keeping their factories outside the United States, either in Mexico or South East Asia.[17] Given that the Trump Administration has begun imposing trade tarrifs on several products imported from China,[18] his threats to take measure that encourage the return of industries should be taken seriously.

39. If Trump's measures are successful, and if some European Governments decide to follow suit, this could lead to reduced trade volumes along the main shipping route that currently passes through the Arab region, thus decreasing revenues from sea transport services in key Arab ports that benefit from the route. Moroever, plans to significantly invest in broadening and developing the ports' work will become economically futile, thus losing potential employment opportunities from those investments.

2. *International trade trends towards emerging economies*

40. An emerging market is a country that has some characteristics of a developed market, but does not meet standards to be a developed market.[19] Although the most prominent emerging countries globally are Brazil, the Russian Federation, India and China, known as the BRIC Group, there are currently 25 countries classed as emerging economies in Asia, Central Europe, the Middle East, Africa and South America.[20] Those countries share common features such as high economic growth over a minimum of three years, the existence of large enterprises, open markets and ease of business; however, they are still susceptible to political, social and financial threats.

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[15] Jean-Louis Mucchielli, *Multinationales et mondialisation* (Paris, Éditions du Seuil, 1998).

[16] Ibid, p. 345.

[17] Ylan Q. Mui, Matea Gold and Max Ehrenfreund, "Trump threatens 'consequences' for U.S. firms that relocate offshore", *The Washington Post*, 1 December 2016. Available at https://www.washingtonpost.com/politics/trump-threatens-consequences-for-us-firms-that-relocate-offshore/2016/12/01/a2429330-b7e4-11e6-959c-172c82123976_story.html?noredirect=on&utm_term=.3e26e550ec47.

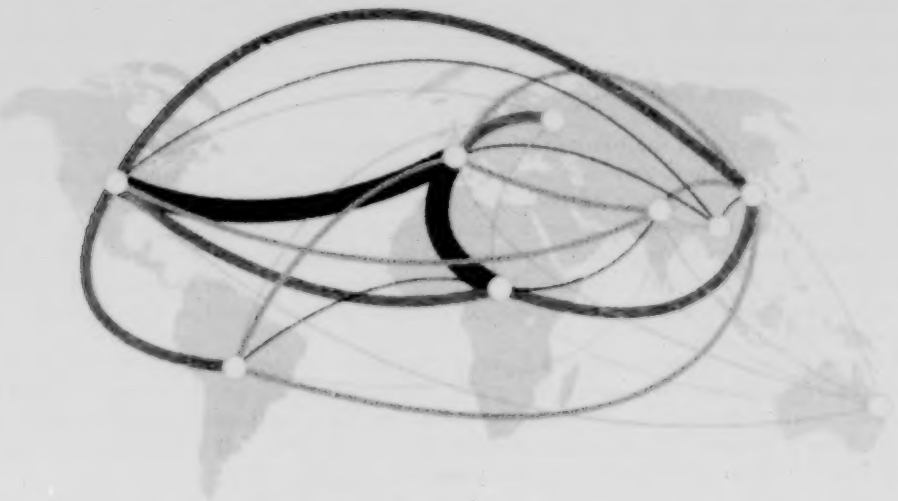
[18] Valentina Romei, "US-China trade tariffs in charts", *Financial Times*, 5 April 2018. Available at www.ft.com/content/e2848308-3804-11e8-8eee-e06bde01c544.

[19] MSCI, "MSCI market classification framework", June 2014. Available at www.msci.com/documents/1296102/1330218/MSCI_Market_Classification_Framework.pdf/d93e536f-cee1-4e12-9b69-ec3886ab8cc8.

[20] MSCI, "MSCI ACWI and frontier markets index", Market-classification database. Available at www.msci.com/market-classification (accessed on 10 May 2018).

41. Transport plays a key role in strengthening emerging economies in terms of international trade, with some experts claiming that the international driver of growth has moved from developed countries to emerging economies.[21,22] Steady growth in gross domestic product (GDP) and in total national wealth in emerging economies could transform transport and international trade streams in the future, with the possibility of a reduced share for the current major shipping route between South East Asia and Northern Europe because of the development of numerous trade flows between emerging economies, and between emerging economies and developed economies. Figure 6 shows the future international network for the exchange of goods, compared with figure 2 depicting the current international trade network that is centred on the principal east-west shipping route.

Figure 6. Future trade streams in the light of growing emerging economies



Source: James Manyika and others, *Global Flows in a Digital Age: How Trade, Finance, People, and Data Connect the World Economy* (New York, McKinsey & Company, April 2014).

3. *Financing for development challenges*

42. To keep pace with increasing needs in Arab countries and developments in global transport, the region must make significant investments in costly transport infrastructure, including roads, railways, airports and seaports.

43. Financial and funding difficulties are major challenges impeding the full establishment of infrastructure networks needed to connect Arab countries.[23] Financing future transport projects has become increasingly difficult as projects become more technologically complex and costly, and has coincided with a sharp drop in Arab countries' revenue and funding allocations for development because of continuing crises in some

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[21] Lesley Wroughton, "Emerging markets set to drive 2018 global growth - World Bank", *Reuters*, 10 January 2018. Available at https://in.reuters.com/article/economy-worldbank/emerging-markets-set-to-drive-2018-global-growth-world-bank-idINKBN1EZ0I0.

[22] Financial Times, "Emerging markets are set to lead globalization: we should embrace the next wave, rather than fomenting a backlash", 10 April 2017. Available at www.ft.com/content/f60d77a4-1ded-11e7-b7d3-163f5a7f229c.

[23] كمال حسن علي، "استعراض الواقع الحالي لربط شبكات البنى التحتية بين الدول العربية في مجال النقل، الاجتماع التشاوري حول محاور الربط الحيوي بين البلدان العربية" (بيروت، الإسكوا، 23 نيسان/أبريل، 2018).

countries and a reduction in petroleum product sales that are the main source of government funding in other countries.

44. In addition, the debt burden in some Arab countries has exceeded a certain level as a share of GDP, thus hampering country efforts to receive development loans for transport infrastructure.

45. The unstable political stuation in the region is an obstacle to potential private sector involvement in financing and operating infrastructure and various transport facilities, thus impeding various forms of public-private partnerships at the national and international levels.

C. Demographic and social factors

46. Demographic and social factors are expected to increase demand for transport services in the future because of population growth, and to alter the nature of that demand in terms of spatial concentration and consumption patterns.

1. *Disparities in population growth*

47. It took hundreds of thousands of years for the world's population to reach 1 billion, which then grew exponentially over 200 years to reach 7 billion in 2011. Estimates show that the world's current population is 7.6 billion.[24]

48. However, recent decades have seen disparities in population growth between high-income countries characterized by stable population growth, and several middle and low-income countries with growing populations (figure 7).

49. Figure 7 shows that most Arab countries are witnessing rapid population growth compared with other countries globally, as are some countries in Central Asia and Africa.

50. Rapid population growth in Arab countries poses significant challenges for future transport systems, which must fulfil increasing demand for the transport of people and goods, thus requiring prior planning to develop transport infrastructure and services that meet the increasing future needs of growing populations.

Figure 7. Disparities in population growth globally

Source: United Nations Population Fund (UNFPA), "World population growth: average annual rate of population change", World Population Trends. Available at www.unfpa.org/world-population-trends (accessed on 10 May 2018).

[24] United Nations Population Fund (UNFPA), "World population growth: average annual rate of population change", World Population Trends. Available at www.unfpa.org/world-population-trends (accessed on 10 May 2018).

51. Not taking population growth into account when planning future transport projects will result in their failure to meet needs and in congestion at transport hubs and on roads, leading to longer travel times and negative environmental effects.

52. Globally, disparities in population growth between high-income and medium- and low-income countries will lead to slower economic growth and weaker demand for goods in northern countries, if consumption patterns remain unchanged therein, which will alter international streams for transporting raw materials and goods. For example, weaker demand for petroleum products in the northern hemisphere will impact their transport, on the one hand, and resources derived from the production and distribution of those products, on the other.

53. Projections show that significant population growth in southern countries will increase transport streams from global production sites for resources, crops and products required to meet population needs, especially when domestic production is not feasible because of a shortage of water resources and desertification.

2. *Urban pressure and the spread of megacities*

54. Population growth in middle- and low-income countries is concentrated in cities because of people's desire for employment opportunities that are no longer sufficiently available in rural areas.

55. The negative impact of migration from rural areas to cities and uncontrolled population growth in cities that poses challenges to sustainable development efforts are the focus of international meetings, such as the recent Arab Forum on Sustainable Development (Beirut, 24-26 April 2018) that dedicated a plenary session to discussing the theme of planning for resilient, inclusive and sustainable cities. Discussions highlighted the dangers of continuing environmental degradation in Arab cities, which might impede their ability to absorb growing populations.[25]

56. Estimates show that cities will comprise two-thirds of the world's population by 2030, mostly in megacities with populations exceeding 10 million.[26]

57. Population growth in cities and the spread of megacities pose significant challenges to future transport services therein, including people's daily transport needs, and to providing inhabitants with the requirements for living in cities such as natural resources, food and clothing.

58. There is consensus that individual transport solutions in large cities will be unrealistic in the future. Wider and new roads will quickly become congested with personal vehicles, resulting in complete gridlock. There is therefore no alternative but to resort to public transport solutions, known as 'heavy solutions', to meet the future transport needs of city-dwellers, such as metro lines, suburban rail and rapid regional transport networks. However, such solutions are very costly, exceeding the financial capacity of some cities and even of many low-income countries. Moreover, it will be necessary to find innovative solutions to attract investments from the private sector in that field without making public transport unaffordable for many social groups, which could be achieved by combining heavy public transport projects and smart real estate development projects, thus repaying private sector investments that cannot be recompensed through public transport projects alone.

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[25] More information on discussions at the Arab Forum for Sustainable Development, which was held in Beirut from 24 to 26 April 2018, is available at www.unescwa.org/events/arab-forum-sustainable-development-2018.

[26] Allianz SE, "The megacity of the future is smart", 30 November 2015. Available at www.allianz.com/en/press/news/studies/151130_the-megacity-of-the-future-is-smart/.

3. *Changing behavioural patterns*

59. Among the large drivers of change in the field of transport, behavioural patterns play a major role in developing transport routes in line with changes in consumption. The Silk Road is the oldest example of this: silk production was well known in China, but the industry was protected for a long time. When other societies became familiar with silk yarns and woven fabric, several routes were established to transport silk from China to European countries. Controlling those routes became a major concern because of the revenue they created, resulting in conflict between neighbouring empires along those routes.

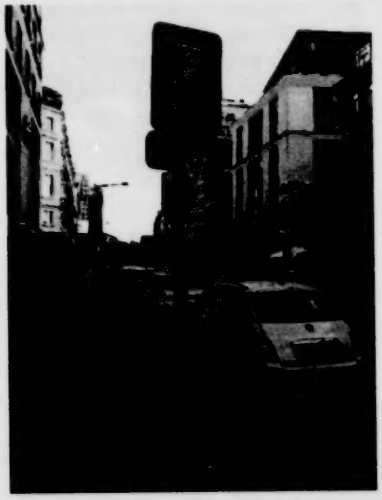
60. Another example of the impact of changing behavioural patterns on transport is the issue of spices that grew in the East Indies. The discovery of those spices by European societies in the middle ages led to significant developments in land and sea transport. The Arab region played a major role in controlling the spice trade. Competition for control of the spice trails led to the establishment of direct sea routes between Europe and the spice lands after the Portuguese sailor Vasco da Gama discovered the possibility of sailing around Africa via the Cape of Good Hope in 1498.

61. In the sixteenth century, the Spanish were introduced to hot chocolate drink, extracted from the cacao tree, which was considered a ritualistic drink in its homeland of Mexico. The transfer of the drink to Belgium and France caused significant developments in solid chocolate and its widespread exchange globally. The same can also be said about coffee, extracted from coffee beans, which is one of the most traded goods across the world in terms of volume.

62. In contrast, healthy consumption patterns and concurrent campaigns resulted in the gradual erosion of smoking habits worldwide, causing a drop in the trade of tobacco globally.

63. New goods are expected to emerge in the future of international trade, following the current strong exchange in laptops and other mobile devices. Changes are also expected in the mindsets of various social groups: for over a century, the idea of owning a car has dominated consumer patterns, allowing those who can afford them to travel freely; however, projections show a decreasing desire to own cars because of the widespread ability to rent cars online and through smartphone applications, enabling people to travel at any time to any place using an appropriate type of vehicle for their travel needs (figure 8).

Figure 8. Rental cars in Brussels booked via a car-sharing smartphone application



Source: Photo taken on 3 July 2017 by author.

64. It is also very likely that people in the future will begin opting for car-sharing options rather than owning a car, especially following the spread of self-driving cars that will meet all travel needs without the stress of parking: after dropping off one passenger, a driverless car can move on to pick up another who is close by, as will be shown further in the present document.

D. Regulation and government

65. The future poses several challenges in the governance of the transport sector related to the stability of current patterns in globalized production and trade, and to the outcomes of the digital revolution and the widespread use of its applications.

1. *Specifications and technical limitations*

66. With the growing popularity of free trade resulting in the exchange of goods across geographically distant regions in a manner that is open to all economic actors, there is a growing need for consensus on the market specifications of goods and on their transport procedures. If standardized specifications for the sale and transport of goods aim to protect consumers and guarantee goods delivery without damage, then the concerns of large international producers must also be taken into account regarding the protection of their products from competition by market newcomers, especially in emerging economies. Pressure groups and lobbyists are attempting to influence many regulatory decisions on specifications issued by international and regional bodies, such as the World Trade Organization and the European Union. The role of pressure groups, which represent private interests, has become more evident in decisions emanating from the Trump Administration, including attempts by the two airline giants United Airlines and American Airlines to encourage the Trump Administration to impose restrictions on the movement of Gulf airlines (Emirates, Etihad and Qatar Airways) to the United States under the pretext of unfair competition. However, they did not succeed because of opposition from large enterprises in the field of airplane manufacturing, which consider Gulf airlines their prime customers; the sale of aircraft provides significant revenue and employment opportunities.[27]

2. *International agreements*

67. International agreements in the field of transport form a general framework for regulating transport activities at the international and regional levels. Agreements are followed up in various ways, according to the type of transport. The International Civil Aviation Organization develops and follows up on air transport agreements, while the International Maritime Organization is reponsible for regulating technical affairs in global sea trasport and for categorizing countries according to their compliance with technical systems on maritime transport, especially those related to safety. The regulation of road transport is shared between the United Nations regional commissions, particularly the Economic Commission for Europe, which has developed 58 agreements[28] on regulating all aspects of road transport in Europe, covering vehicle safety and specifications and the standardization and facilitatation of various cross-border international transport processes (figure 9).

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[27] Zahraa Alkhalisi and Jon Ostrower, "American airlines want Trump to take on their Gulf rivals", *CNN*, 7 February 2017. Available at http://money.cnn.com/2017/02/07/investing/airlines-american-gulf-carriers-trump/index.html.

[28] United Nations Economic Commission for Europe, "Number of UN transport conventions and agreements per country" Transport database. Available at www.unece.org/trans/maps/number-of-un-transport-conventions-and-agreements-per-country.html (accessed on 10 May 2018).

Figure 9. Countries' accession to land transport agreements

Source: United Nations Economic Commission for Europe, "Number of UN transport conventions and agreements per country". Transport database. Available at www.unece.org/trans/maps/number-of-un-transport-conventions-and-agreements-per-country.html (accessed on 10 May 2018).

Note: Dark to light green denotes the number of transport agreements per country from high to low.

68. Figure 9 shows the weak accession of Arab countries to international land transport agreements, with the exception of Morocco and Tunisia, which could pose future challenges to Arab countries' ability to transport exports by land to potential markets, especially given other countries' high accession rates, particularly in neighbouring regions.

69. ESCWA is monitoring the implementation of two regional agreements on international roads and railways, and is encouraging all Arab countries to accede to them to ensure compatibility between countries on road and rail connections for stronger Arab regional integration, and on common technical specifications for those connections. Similarly to international agreements, accession to the ESCWA agreements and commitment to their implementation raise challenges for facilitating regional connections and the smooth flow of goods and people via road transport between Arab countries and between the Arab region and the rest of the world.

3. *Open governance and social participation in performance evaluation*

70. Modern technology has caused transformations in governance and performance evaluation in various transport fields, such as gradually increasing transport beneficiaries' participation in evaluation processes in an open and transparent manner. For example, mobile taxi applications, such as Uber and Careem, enable users to rate their services and provide the cumulative outcomes of customer evaluations through star ratings between one and five, thus benefiting drivers who maintain high ratings and informing users of their prospective driver's rating before they accept the ride.

71. All beneficiaries of transport services provided by enterprises or individuals can participate in this evaluation process, thus gradually increasing competition to improve service quality and, in turn, improving services to meet user requirements, while replacing evaluation processes by third parties with customer direct reviews.

E. Political factors and conflict

72. The potential impact on the transport sector of political crises and conflicts raging in some Arab countries since the turn of the century should be taken into account, especially those in Iraq, Libya, the Syrian Arab Republic and Yemen and the decades-long Israeli occuation in Palestine. There are also growing concerns on the spread of such conflict to Gulf countries following the ongoing blockade of Qatar recently imposed by neighbouring countries.

73. History has shown the effects of conflict and war on altering regional transport routes, which could lead to the disappearance of traditional routes and the establishment of temporary or permanent alternative routes.

74. The main impact of conflict and war is reflected in the closure of traditional routes, which could negatively impact parties that benefited from the exchange of goods before the start of the conflict. For example, the Russo-Turkish War (1768-1774) led to the annexation of Crimea from the Ottoman Empire, thus depriving the Turkish Anatolian plateau of the ability to exchange goods in that area of the Black Sea which used to be a traditional market for fabric produced in Antolia. Moreover, the collapse of the Ottoman Empire after the First World War and the redrawing of borders separated Aleppo from its fabric market in Cilicia thus negatively impacting Aleppan fabric producers. The French mandate prohibited the export of Aleppan fabrics to other markets, leading to the industry's collapse during that period.[29]

75. The conflict in the former Republic of Yugoslavia in the 1990s cut off land transport between Greece and other European countries, which was substituted with sea routes that were opened as a temporary solution but became permanent, thus replacing the truck routes that never reclaimed their role following the end of the conflict and the break-up of Yugoslavia.

76. Today, the Syrian conflict has cut off road transport routes that linked Lebanon and Turkey to Gulf countries. An alternative route for Turkish exports has emerged using roll-on/roll-off ships via Haifa and Jordan, which Israel is striving to promote as a permanent transit route.

F. Technological and digital revolutions

1. *Solar energy*

77. The sun is the original source of energy for life on Earth. Other than nuclear power and thermal energy from within the Earth, all other types of energy used by human beings are derived directly or indirectly from solar energy. This applies to most energy used since the spread of internal combustion engines in the second half of the nineteenth century; in other words, the energy created by burning fossil fuels, such as coal, gas and petroleum derivatives. Such resources are created through geological pressure over millions of years on layers of plankton, which would not have existed in the first place without solar energy.

78. The direct use of solar energy to generate electricity to operate machinery used daily in industry and transport appears more efficient and logical than waiting several million years for the creation of more fossil fuels.

79. The transformation from fossil fuel-reliant internal combustion engines to sustainable electricity from solar energy is not the result of fears that fossil fuels are becoming depleted, but rather aims to achieve energy efficiency. Similarly, the transformation from the Stone Age to the Bronze Age was not caused by the depletion of stones, but because of the discovery of a more efficient material for making better tools that helped human beings advance, which they used for agriculture, hunting, protection, construction and maintenance in their daily lives.

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[29] Donald Quataert, *The Ottoman Empire 1700-1922*, 2nd ed (Cambridge, Cambridge University Press, 2005), p. 127.

80. Relinquishing oil will cause a large drop in revenue in many Arab countries, which can only be compensated through early investments in projects to generate electricity from solar energy, similar to the giant projects announced by Saudi Arabia.[30]

2. *Hyperloop trains*

81. Hyperloop trains will be available in the near future, most likely by 2030. They are a promising invention that could significantly impact the future of transport.

82. These trains, which travel within a tube or tunnel above ground at a speed of around 1,000 kilometres per hour, will pose a considerable challenge for air transport because of their safety and low-energy use compared with air travel. They might change consumption patterns, especially if they are available from city centres like ordinary trains, rather than having to travel relatively far to reach airports that are generally located at a distance from cities and large urban areas.

83. As was the case in the 1980s when high-speed trains were introduced, hyperloop trains travelling at 1,000 kilometres per hour could cause a significant transformation by drastically reducing the space-time ratio. For example, an individual living in a city 500 kilometres away from the capital which is serviced by a hyperloop train will in practical terms be closer to the capital that an individual living 30 kilometres away but has to use low-speed and congested transport.

3. *Self-driving vehicles*

84. Driverless vehicles might be the most significant outcome of the digital revolution in the field of transport. Many car manufacturers are currently working on producing driverless vehicles, which are being tested in several American and European cities. Such vehicles are expected to be ready for commercial distribution by 2020, with numerous positive and negative effects. Their positive impact includes providing individual transport services across a wider age group, especially among older persons; significantly reducing traffic congestion; increasing road safety; and freeing up large spaces reserved for parking cars, which will lead to significant improvements in infrastructure and larger recreation and pedestrian areas. However, numerous challenges will have to be overcome before enjoying those benefits, resulting from traditional vehicles and driverless vehicles being on roads simultaneously during a transition period.

85. The spread of driverless vehicles is expected to drastically alter perspectives on transport, with people no longer needing to own cars to travel freely. The concept of private vehicle ownership for the masses coincided with the spike in car production after the Second World War, when private cars were promoted as the only efficient method of transport. Private cars became a widespread commodity, similar to fridges and washing machines. Today, they come in all shapes and sizes to meet the needs of those who can afford them: a classic car for city streets, a four-wheel drive for mountainous areas and sports cars, just to name a few.

86. A 2016 study by the Organization for Economic Cooperation and Development indicates that shared use of small (six passengers) and medium (8-16 passengers) vehicles can meet travel needs in a medium-sized European city like Lisbon by using only 3 per cent of the number of existing vehicles. The study estimates that a single shared vehicle will travel ten times farther than current vehicles, but the overall sum of kilometres travelled daily will drop by 37 per cent, even during rush hour. It also projects that 95 per cent of areas currently reserved for parking in cities will be freed up, and that the cost of city travel will be cut by half.[31] Similar results can be expected from ride-sharing in driverless cars, thus eliminating the need to buy such vehicles if enough driverless cars are provided to transport people in cities similarly to taxi services currently available

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[30] Ellen R. Wald, "Saudi Arabia to build massive solar power installation", 29 March 2018. Available at www.forbes.com/sites/ellenrwald/2018/03/29/saudi-arabia-to-build-massive-solar-power-installation/#5db76b377a90.

[31] International Transport Forum, *Shared Mobility: Innovation for Liveable Cities* (Paris, Organisation for Economic Cooperation and Development, 2016), p. 8.

via mobile applications such as Uber and Careem, with the key difference that self-driving cars will have no driver and will respond to passengers' travel needs through specific algorithms for individual or shared use, which are similar, in principle, to the services provided by lifts in buildings.

87. In a book from the year 2000 entitled *The Age of Access*,[32] Rifkin claims that future technology will eliminate the concept of ownership and will replace it with paid services. The author foresees the end of ownership of physical goods as a driver of production and growth, which will be substituted with intangible ideas and regulation to generate wealth and prosperity. He also posits that the changes accompanying this transformation will encourage enterprises and individuals to gradually get used to renting commodities, including cars and houses, instead of buying them.

88. The negative impact of driverless vehicles will begin in the transition stage, which will witness unprecedented challenges in road safety that will gradually be resolved. The main concern with self-driving vehicles is that they will make the driving profession redundant, because both private and public vehicles will drive themselves. Special attention should be paid to the social impact of losing hundreds of thousands of jobs currently provided by the transport sector in many countries.

4. *Directly linking transport supply and demand by eliminating intermediaries*

89. The digital revolution is playing a growing role in bringing people closer together and in facilitating access to various services through smartphones, such as restaurant, cinema, hotel and travel ticket bookings, which required the assistance of a third party in the past. The services revolution has made such transactions possible via mobile devices, including electronic payments.

90. Connections provided by Uber and other companies highlight the quality of such taxi services, which will eventually make traditional taxi services obsolete. Following its success in providing taxi services, Uber is now aiming to broaden its services to include road freight through instant connections between lorry drivers and freight customers, including electronic payment following clearance, without the need for tough negotiations and haggling with brokers and transport intermediaries.[33]

91. Given the decline in the use of travel agents to book flights and hotels following the prevalence of direct electronic booking services, it is only a matter of time before intermediaries become redundant in transport contracts, starting with road transport then rail, sea and air transport. Social implications will arise from the loss of many jobs in intermediary companies.

92. In a recent study on the future of truck manufacturing worldwide, Deloitte expects a steady increase in the operating efficiency of fleets in developed countries resulting from the widespread use of digital applications to effectively link supply and demand for land freight. The study projects that annual global demand for new trucks will drop to 0.6 per cent until late 2026, and to -0.9 per cent annually between 2016 and 2021 in developed countries in Northern Europe, North America and Asia, reaching an average of -1.4 per cent annually by 2026.[34]

93. Authorities responsible for regulating the transport of goods in Arab countries will benefit from pre-empting these changes by standardizing transport operations in line with country specificities, according to the nature and volume of the transported material, distances and delivery deadlines, while taking into account safety and environmental aspects. Such normative activities would benefit from partnerships between cargo regulators and digital application development companies to ensure their success.

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[32] Jeremy Rifkin, *The Age of Access: The New Culture of Hypercapitalism Where All of Life is a Paid-for Experience* (New York, Putnam Publishing Group, 2000).

[33] Uber Freight. Available at https://freight.uber.com.

[34] Deloitte, *Global Truck Study 2016: The Truck Industry in Transition* (London, 2017).

III. CONCLUSION

94. Transport systems in countries and regions are governed by their surrounding environment, with its geographic, population, social, economic, government, political and technological dimensions that are interconnected and have reciprocal effects on one another. Consequently, it is not possible to study individual effects of drivers of change; it is necessary to evaluate the interactions of those effects when designing the future of the transport sector.

95. For example, the geographic environment, with its varied terrain (mountains, valleys, seas, lakes and rivers), can restrict the development of transport at a given stage. Subsequently, because of the impact of other factors such as technology, those obstacles can be overcome by establishing transport tunnels through difficult terrain, thus connecting areas that were previously separated.

96. Roads linking neighbouring provinces might not witness significant volumes of transport for long periods because of a lack of transport modes, until an economic or technological transformation allows for the development of flexible transport modes such as microbuses that can be efficiently used to transport passengers between neighbouring provinces. Moreover, such transport modes can link rural and urban areas, thus reducing internal migration by providing comfortable commutes to cities and equipping rural areas with drinking water, sanitation, education and health services.

97. Legislation and regulatory decisions play a major role in promoting or deterring the entrance of new actors to the transport sector, and in strengthening or weakening competitiveness in providing transport services, which positively or negatively affects service quality and sustainability.

98. Finally, crises and conflicts impede the stability required for the private sector to fulfil its role in building and operationalizing infrastructure and transport hubs, in addition to weakening Government capacity to establish and maintain various transport systems because of a shortage of financial resources.

IV. PROPOSED METHODOLOGY FOR THE DETAILED STUDY

99. The ESCWA secretariat prepared the present concept note on megatrends in the transport sector and their potential impact on the Arab region as an introduction for a detailed study on the topic under the proposed ESCWA project on formulating a strategic vision to develop a multimodal transport system in the Arab region.

100. The detailed study will be prepared in the following three phases:

Phase one: carrying out a theoretical study, including completing desk work and broadening references on the topic to strengthen the hypotheses set out in the present concept note.

Phase two: checking the hypotheses through discussions at three expert group meetings on trends in air, sea and land transport, as follows:

- Air transport: hold an expert group meeting in Beirut, in collaboration with the Arab Air Carriers Organization, with special focus on securing the necessary financial support in partnership with relevant Arab airlines;

- Sea transport: hold an expert group meeting in Alexandria, Egypt, in collaboration with the Arab Academy for Science, Technology and Maritime Transport and Arab unions involved in sea transport in Alexandria;

- Land transport: hold an expert group meeting in Amman, in collaboration with the Arab Union of Land Transport.

Phase three: formulating scenarios on key drivers of change in transport and on resulting expected transformations at the global level over the period 2030-2050, for use as a doorway for comprehensively planning a multimodal transport system in the Arab region. Those scenarios are principal components of the ESCWA project on formulating a strategic vision to develop a multimodal transport system in the Arab region, complemented by a roadmap for developing infrastructure and reforming policies to ensure that multimodal transport plays a key role in enhancing Arab regional integration, so as to achieve inclusive and sustainable development in Arab countries.